REMARKS

Claims 82-112 are pending in this application. Claims 82, 83, 86, 88, 91, 96, 99, 106, 111, and 112 have been changed and claims 84, 85, 87, 100, 101, 108, and 109 have been cancelled by this Amendment.

Applicant hereby notifies the Examiner of related U.S. Application No. 09/376,649, filed 8/18/99, which is a continuation-in-part of a parent of the present application.

The Examiner objected to Fig. 12 of the drawings due to reference number 208 pointing to transducer 214b instead of the ground member. The number has been corrected as shown in red on the drawing sheet attached hereto. A clean, corrected formal sheet is also attached.

The Examiner objected to claim 82 at line 2, stating that "detecting" should be "detect." Applicant has corrected claim 82 as set forth above.

The Examiner rejected claim 99 under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicant regards as the invention. Applicant has corrected "manipulable" to "manipulatable" in claim 99 as set forth above and respectfully requests that the rejection be withdrawn.

The Examiner rejected claims 102 and 103 under 35 U.S.C. 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s) had possession of the claimed invention. The Examiner stated that claim 102 recites a structure that was not described in the specification. However, Applicant believes the recited structure is described. Referring to Fig. 15 as an example, as recited in claim 99, there is a first member 212b coupled to the user manipulatable object 44 (coupled via member 216, which can be part of the object 44 or a separate member); a second member 210b coupled to the first member 212b by flex (the first member 212b is flexible); a third member 212a coupled to the first member 212b (via member 216) by flex (since both members 212b and 212a are flexible), where the members 210b, 212b, and 212a form a unitary member-- these members (and member 216) of Fig. 15 can be formed as a unitary member using a plastic mold, for example. And, as recited in claim 102, second member 210b is coupled to ground 208 (via actuator 214a) and a fourth member 210a is coupled to third member 212a and to ground 208 (via actuator 214b), where flex is provided between third member 212a and fourth member 210a, since third member 212a is flexible. Applicant therefore believes that the subject matter of claim 102 is adequately described in the specification and respectfully requests that the rejection under 112, first paragraph, be withdrawn.

The Strandh Reference

The Examiner rejected claims 82-92, 94, 95, 97, 99-101, and 104-112 under 35 U.S.C. 102(b) as being anticipated by Strandh. Applicant believes that claim 82 is not anticipated by Strandh. Amended claim 82 recites a linkage coupled to a user manipulatable object and providing at least two rotary degrees of freedom to the user manipulatable object. Strandh clearly does not disclose providing rotary degrees of freedom to his disclosed joystick. For example, in col. 3, lines 34-41, Strandh describes that the "actuator [joystick] is confined to bodily substantially translatory motion in a plane parallel to a pair of fixed axes x and y, but it can move in all directions in that plane... [t]hus the actuator can be displaced from its normal position in directions parallel to the axis x, or in directions parallel to the axis y..." This, clearly, is motion that is parallel to linear axes and is confined to a plane, and thus is not rotary motion. The Examiner states (e.g., for claim 84) that the component directions Sx and Sy (col. 3, lines 41-45) disclose revolute degrees of freedom. However, it is believed that these Sx and Sy component directions are components of motion within the x-y plane: Strandh states that the motion may be "resolved into a component Sx along the x axis and a component Sy along the y axis," indicating that diagonal motion may be possible, but only parallel to the linear x and y axes and thus within the plane. These are not rotary degrees of freedom about axes of rotation as recited by Applicant. Nowhere does Strandh disclose rotary motion, and in fact his disclosed mechanism (having rollers 33 move parallel to the x-y plane) cannot conceivably provide the claimed rotary motion, so that not even the suggestion of axes of rotation for joystick is made by Strandh's flex mechanism. Therefore, Applicant believes that Strandh nowhere discloses or suggests the claimed rotational degrees of freedom and that claim 82 is patentable thereover.

Claims 83 and 86-98 are dependent from claim 82 and are believed patentable for at least the same reasons as claim 82 and for additional reasons. For example, amended claim 83 recites an electronically-controllable actuator able to apply a force along at least one degree of freedom; Strandh discloses no electronically-controllable actuator. Claims 86 and 87 recites that the plurality of members of the linkage are formed as a closed-loop linkage. The Examiner states that Strandh teaches a closed-loop linkage since the members 37, 14, 39, 26, 15, 16, and 6 are fixed and integral to each other. However, Strandh discloses a structure in which member 16 branches off from the closed loop of members including members 37, 14, 26, 15, and 39. Member 16 is not part of the closed loop and therefore Applicant believes that claims 86 and 87 are patentable over Strandh. Claim 88 recites that the central members are coupled to each other approximately at the coupling of the user object to at least one of the central members; Strondh, in contrast, discloses that the "central" members 14 and 15 are coupled to each other at member 26, which is separated from the joystick 5 by lever 16, so that the central members are not coupled to each other approximately at the user object. Claim 91 (amended for clarification) recites that the first and second extension members are rotatably coupled to ground by bearings, the bearings allowing the first and second extension members to be rotated about the axes of

rotation. The bearings 32, 33, and 34 of Strandh allow only linear movement of the members 37, 26, and 39.

Claim 99 recites a flexure linkage including a first member, a second member, and a third member forming a unitary member, where the linkage provides at least two rotary degrees of freedom to the user manipulatable object about axes of rotation. As explained above with respect to claim 82, Strandh does not disclose or suggest providing rotational degrees of freedom to a joystick, but only discloses or suggests motion within a plane. Applicant therefore believes that claim 99 is patentable over Strandh. Claims 102-105 are dependent from claim 99 and are believed patentable for the same and additional reasons.

Claim 106 recites a method for interfacing motion including providing flex in a linkage to provide at least two rotary degrees of freedom about axes of rotation. As explained above, Strandh does not disclose rotary degrees of freedom about axes of rotation for a user object, so that claim 106 is believed patentable over Strandh. Claims 107 and 110-111 are dependent on claim 106 and are believed patentable over Strandh for at least the same reasons and for additional reasons. For example, claim 110 is patentable for reasons similar to claim 86 as explained above, and claim 111 is patentable for reasons similar to claim 96.

Claim 112 recites an apparatus for interfacing motion of a user with a computer system, and includes linkage means for providing at least two rotary degrees of freedom to the user manipulatable object. Therefore, claim 112 is believed patentable over Strandh for reasons similar to those explained above.

In view of the foregoing, Applicant beleives that claims 82-92, 94, 95, 97, 99-101, and 104-112 are patentable over Strandh, and respectfully requests that the rejection under 102(b) be withdrawn.

The Chuang Reference

The Examiner rejected claims 82-84, 86-91, 93-95, 97, 99, 100, 104, 106-108, 110, and 112 under 35 U.S.C. 102(b) as being anticipated by Chuang. Applicant respectfully traverses. Chuang discloses a joystick device having a joystick handle 22, a ball joint 24 for rotation, and springs 26 connected to the handle 22 to provide resistance or bias to joystick motion. In contrast, claim 82 recites a linkage including a plurality of members, where a selected number of members is formed as a unitary member in which flex is provided between the selected number of members. Chuang discloses separate components of a joystick handle, ball joint, and springs which have been assembled; none of these members has been formed with any others as a unitary member. The Examiner states that "unitary member" includes parts assembled to be act as a unit. However, Applicant disagrees. Applicant's specification states that, in the example of Fig.

12, a "unitary member" is created where "four members are formed and produced coupled together as segments of a single part or 'flexure'." (page 32, lines 14-19). Thus, in this example, the four members are formed and produced as a single part that already includes the four members. This is further supported on page 32, lines 20-24, which state: "Since the members ... are formed as a unitary part, bearings or joints between these members do not need to be separately manufactured and the extensive assembly process for these members is not necessary." etc. The device of Chuang includes components such as springs, rods, nuts, screws, and ball joints which clearly must be separately manufactured and then assembled at a later time (with appropriate bearings) to form the joystick mechanism, and thus clearly do not fall within the term "unitary member" as defined in the specification and recited in claim 82. Applicant therefore believes that claim 82 is patentable over Chuang. Claims 83 and 86-98 are dependent on claim 83 and are patentable over Chuang for at least the same reasons and for additional reasons. For example, Chuang does not disclose the closed loop linkage structure of claim 88 (the ball joint 24 of Chuang provides the rotational degrees of freedom to the joystick 22, not the springs or screws).

Claim 99 recites first, second, and third members that form a unitary member, and so is believed patentable for reasons similar to those explained above for claim 82. Claims 102-105 are dependent on claim 99 and are patentable for at least the same reasons as claim 99 and for additional reasons. Claim 106 recites a selected number of members in a linkage are formed as a unitary member, and so is believed patentable for reasons similar to those explained above for claim 82. Claims 107, 110, and 111 are dependent on claim 106 and are patentable for at least the same reasons as claim 106 and for additional reasons. Claim 112 recites a plurality of members in a linkage means formed as a unitary member, and so is believed patentable for reasons similar to those explained above for claim 82.

In view of the foregoing, Applicant believes that claims 2-84, 86-91, 93-95, 97, 99, 100, 104, 106-108, 110, and 112 are patentable over Chuang, and respectfully requests that the rejection under 102(b) be withdrawn.

The Salcudean Reference

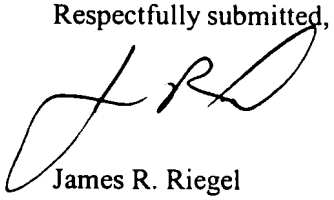
The Examiner rejected claims 82, 93, and 98 under 35 U.S.C. 102(e) as being anticipated by Salcudean et al., Patent No. 5,790,108. Applicant respectfully traverses. Claim 82 recites a linkage including a selected number of members formed as a unitary member in which flex is provided between the selected number of members, where the flex permits motion between the selected number of members that allows motion of the user object in at least one of the rotary degrees of freedom. No such flex between members is disclosed by Salcudean. The Examiner states that all elements have some flex, but Salcudean is not using flex to permit motion between

selected members to allow motion of a user object in at least one rotary degree of freedom. Therefore, Applicant believes that claim 82 is patentable over Salcudean. Claims 83 and 98 are dependent from claim 82 and are believed patentable for at least the same reasons as claim 82.

Applicant has added claim 113, which includes the subject matter of claims 96 and 88 and which was indicated to be allowable by the Examiner. Applicant therefore believes claim 113 is patentable.

Applicant believes that all pending claims are allowable and respectfully requests a Notice of Allowance for this application from the Examiner. Should the Examiner believe that a telephone conference would expedite the prosecution of this application, the undersigned can be reached at the telephone number set out below.

Respectfully submitted,



James R. Riegel
Reg. 36,651

San Jose, California
(408) 467-1900

MARKED-UP VERSION OF AMENDMENTS

In the Claims:

All pending claims are reproduced below. Claims which have been changed by this amendment are indicated as "amended."

82. (amended) An interface apparatus for interfacing motion of a user with a computer system, said interface apparatus comprising:

a user manipulatable object physically contacted by said user and moveable by said user in at least two rotary degrees of freedom;

a linkage coupled to said user manipulatable object and providing said at least two rotary degrees of freedom to said user manipulatable object, each rotary degree of freedom being about an axis of rotation, said linkage including a plurality of members, wherein a selected number of said plurality of members [are] have been formed as a unitary member in which flex is provided between said selected number of members, said flex permitting motion between said selected number of members that allows motion of said user manipulatable object in at least one of said rotary degrees of freedom; and

at least one sensor able to [detecting] detect a position or motion of said user manipulatable object along said at least two degrees of freedom and outputting sensor signals, wherein said sensor signals, or a representation thereof, are received by said computer system.

83. (amended) An interface apparatus as recited in claim 82 further comprising an electronically controllable actuator coupled to said linkage and able to apply a force along at least one of said at least two degrees of freedom to said user manipulatable object through said unitary member.

Please cancel claims 84 and 85 without prejudice.

86. (amended) An interface apparatus as recited in claim 82 wherein said plurality of members of said linkage are formed as a closed-loop linkage in which said members are flexibly coupled to each other as segments of said unitary member.

Please cancel claim 87 without prejudice.

88. (amended) An interface apparatus as recited in claim [87] 86 wherein said closed loop linkage includes:

a ground member coupled to a ground surface;

first and second extension members, each extension member being coupled to said ground member; and

first and second central members, said first central member having an end coupled to said first extension member and said second central member having an end coupled to said second extension member, wherein said central members are coupled to each other at ends not coupled to said extension members and wherein at least one of said central members is coupled to said user manipulatable object, said central members coupled to each other approximately at said coupling of said user manipulatable object to said at least one of said central members.

89. An interface apparatus as recited in claim 88 wherein said central members are coupled to an object member which is coupled to said user manipulatable object.

90. An interface apparatus as recited in claim 88 wherein said first and second central members are flexible and wherein said first and second central members and said first and second extension members are flexibly coupled to each other and form said unitary member.

91. (amended) An interface apparatus as recited in claim 88 wherein said ground member is rotatably coupled to said first and second extension members by bearings, said bearings allowing said first and second extension members to be rotated about said axes of rotation.

92. An interface apparatus as recited in claim 86 wherein at least one of said members flexibly coupled in said unitary member is relatively narrow in a dimension in which said member is desired to flex, and is relatively wide in other dimensions in which said member is desired to be stiff.

93. An interface apparatus as recited in claim 83 wherein said actuator is a first actuator coupled to a ground member, and further comprising a second actuator coupled to a ground member of said linkage, said second actuator being operative to apply a force in a degree of freedom to said user manipulatable object in response to signals received from said computer system.

94. An interface apparatus as recited in claim 88 wherein said central members are flexibly coupled to an object member which is coupled to said user manipulatable object.

95. An interface apparatus as recited in claim 88 wherein said end of said first central member is flexibly coupled to said first extension member, and said end of said second central member is flexibly coupled to said second extension member.

96. (amended) An interface apparatus as recited in claim 88 [wherein said two degrees of freedom are rotary degrees of freedom, each degree of freedom being about an axis of rotation, and] wherein said two axes of rotation are fixed with respect to said ground member, said first and second extension members being rotatable about said fixed axes of rotation, and wherein said central members are rotatable about first and second floating axes, said floating axes being movable with respect to said ground member.

97. An interface apparatus as recited in claim 82 wherein said user manipulatable object is a joystick handle.

98. An interface apparatus as recited in claim 83 wherein said actuator includes a voice coil actuator for imparting a force on said user object using magnetic fields and controlled by an electrical current.

99. (amended) A flexure linkage for providing motion to a user [manipulable] manipulatable object of an interface device, said interface device in communication with a computer system, said flexure linkage comprising:

a first member coupled to said user manipulatable object;

a second member coupled to said first member, wherein flex is provided between said second member and said first member; and

a third member coupled to said first member, wherein flex is provided between said third member and said first member, and wherein said first, second and third members form a unitary member;

wherein said flexure linkage provides at least two rotary degrees of freedom to said user manipulatable object about axes of rotation with respect to a ground such that said user manipulatable object can be moved by a user in said at least two rotary degrees of freedom and a position of said user manipulatable object in said two rotary degrees of freedom can be provided to said computer system.

Please cancel claims 100 and 101 without prejudice.

102. A flexure linkage as recited in claim 99 wherein said second member is coupled to a ground, and further comprising a fourth member coupled to said third member and to ground, wherein flex is provided between said third member and said fourth member.

103. A flexure linkage as recited in claim 102 wherein said members of said linkage are formed as a closed-loop linkage.

104. A flexure linkage as recited in claim 99 wherein said first and second members are coupled to an object member which is coupled to said user manipulatable object.

105. A flexure linkage as recited in claim 99 wherein at least one of said members flexibly coupled in said unitary member is relatively narrow in a dimension in which said member is desired to flex, and is relatively wide in other dimensions in which said member is desired to be stiff.

106. (amended) A method for interfacing motion of a user manipulable object with a computer system, the method comprising:

providing said user manipulatable object physically contacted by a user and moveable by said user;

providing a linkage including a plurality of members;

providing flex between a selected number of said members to provide at least two rotary degrees of freedom to said user manipulatable object about axes of rotation, wherein said selected number of members are formed as a unitary member; and

sensing a position or motion of said user manipulatable object in said at least two rotary degrees of freedom and outputting sensor signals, wherein said sensor signals, or a representation thereof, are received by said computer system.

107. A method as recited in claim 106 further comprising applying a force along at least one of said at least two degrees of freedom to said user manipulatable object through said unitary member.

Please cancel claims 108 and 109 without prejudice.

110. A method as recited in claim 106 wherein said plurality of members of said linkage are formed as a closed-loop linkage.

111. (amended) A method as recited in claim 106 [wherein said two degrees of freedom are rotary degrees of freedom, each degree of freedom being about an axis of rotation, and] wherein said two axes of rotation are fixed with respect to said ground member, said first and second extension members being rotatable about said fixed axes of rotation, and wherein said

central members are rotatable about first and second floating axes, said floating axes being movable with respect to said ground member.

112. (amended) An apparatus for interfacing motion of a user with a computer system, said apparatus comprising:

user manipulation means physically contacted by said user and moveable by said user in at least two rotary degrees of freedom;

linkage means for providing said at least two rotary degrees of freedom to said user manipulatable object, said linkage means including a plurality of members formed as a unitary member in which flex is provided between said members; and

sensing means for detecting a position or motion of said user manipulatable means along said at least two rotary degrees of freedom and outputting sensor signals, wherein said sensor signals, or a representation thereof, are received by said computer system.